# Assessing the Revenue-Capture Potential from Recreational Fees

R. Jeff Teasley, John C. Bergstrom, H. Ken Cordell

Abstract—A traditional contingent valuation approach and a "trip response method" were examined as potential techniques for measuring public area recreation revenue-capture potential. Empirical results suggest that both methods are useful for assessing revenue-capture potential. Additional research on alternative methods for assessing recreation revenue-capture potential is encouraged.

Keywords: resource economics, public land management, recreation fee valuation of non-marketed commodities.

## INTRODUCTION

As a result of increased recreational demand and reduced management budgets, public resource management agencies are taking longer looks at the revenue capture potential of recreational areas and facilities. Techniques for measuring revenue capture potential via alternative user fee mechanisms are developed which can be employed into a recreation area management strategy. An empirical case study is presented including general model specifications, data collection procedures, and a estimation results overview outlining these techniques. The potential uses and general implications of this research are discussed last.

## CONCEPTUAL BACKGROUND

### Revenue Capture

Revenue capture by a resource management agency implies acquiring funds from consumers/users. In this research we talk about capturing some additional funds from recreation users of two National Forests. In most cases, additional funds are gained by raising the price of site use or instituting a different fee structure. Hence, revenue capture could alternately be termed consumer surplus capture.

Referring to figure 1, at trip quantity level $Q_1$ and price level $P_1$, consumer surplus is equal to the area **$P_1$ac**. Revenues accruing to the managing agency are equal to the area **$P_1$cfT**. This area is the rectangle with edges bounding **T** (out-of-pocket travel expenditures) and **$P_1$** (total trip expenditures). The current site use fee equals **$P_1$-T**.

Raising the site use fee to **($P_2$-T)** reduces consumer's surplus to the triangle **$P_2$ab**. A large portion of the lost consumer's surplus **($P_2$bc$P_1$)** is captured by the managing agency in the form of additional revenues equal to area **$P_2$be$P_1$**. Note, however, that the agency also loses revenues equal to area **ecfg** because of the trip decrease from **$Q_1$** to **$Q_2$**.

Research Coordinator and Associate Professor, respectively, Department of Agricultural and Applied Economics, The University of Georgia, and Research Forester, USDA Forest Service, Athens, GA.

The total revenue received by the site at the higher site use fee is equal to the area $P_2bgT$. Note that the small triangle bce is not captured with the increase in fees. This area is termed deadweight loss and is, as the name implies, lost to both producer and consumer when price is raised to $P_2$. While this deadweight loss is important in social welfare considerations, as long as the gain in revenues ($P_2beP_1$) is greater than the loss (ecfg), increasing the site use fee will increase revenues at a site.

Revenue can be collected by any number of methods. Daily admission passes, vehicle admission fees, hotel taxes, local guide services, and the establishment of special funds for maintenance of recreational areas are a few possible strategies for revenue capture (Loomis and Thomas 1989; Price 1990; Walsh 1986).

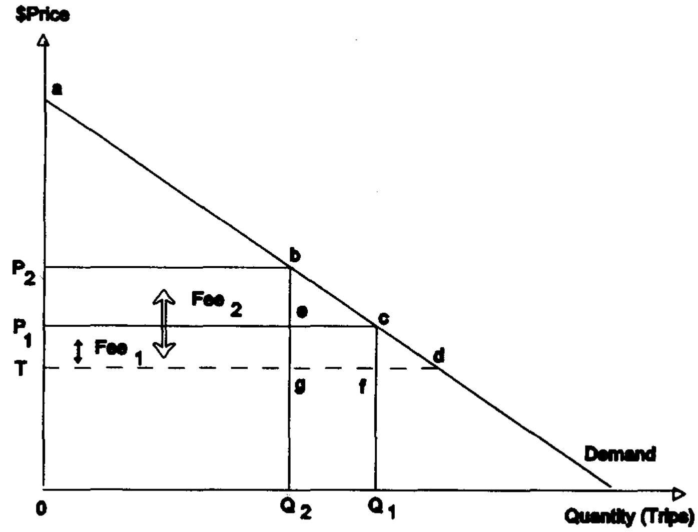


Figure 1—Increasing existing fee amounts.

In order to assess revenue-capture potential under different payment strategies, some general tools must be available for estimating consumer surplus, or willingness-to-pay (WTP), associated with recreation trips. One such tool is a bid probability function, estimated using the contingent valuation method. Another such tool is a site demand function, estimated using what is termed in this paper the trip response method.

Estimation Methods

The specific form of the contingent valuation method used in this study was the dichotomous choice approach (DCA). This technique was first used by Bishop and Heberlein in 1979 in the valuation of "extra" market goods (e.g., environmental amenities). The technique has subsequently been developed and expanded upon to value a variety of non-marketed goods (Bowker and Stoll 1988; Cameron 1988; Hanemann 1984; McConnell 1990; Sellar and others 1986). The application of this technique involves the construction of a hypothetical market or referendum (like any other CVM application) where respondents are asked to answer "yes" or "no" to a single dollar amount or posted price. The strength of the DCA is its simplistic nature and ease of implementation in a survey format. The closed-ended format is also argued to be more "market like" in that respondents can either "take-it-or-leave-it". Respondents are likely more accustomed to seeing market decisions in this format (McConnell 1990).

As many authors have argued, valuation measures attained through contingent valuation studies have both theoretical validity and consistency with market demand-based values (Bergstrom 1989; Cummings and others 1986; Walsh 1986). The ability of the CVM technique to provide estimates of willingness-to-pay makes it a very useful tool to employ for the valuation of recreation. Managers of recreation resources can use these values as a base for funding plans as well as implementing charging schemes. It is noted that some consider WTP only one of many interpretations that may be place upon an individual's value for a non-market commodity.

A CVM-based bid probability function can be specified generally by

(1) $$PROB = ](P, M, X),$$

where PROB is the probability that a respondent is willing-to-pay a given posted price, P is the posted price amount, M is household income, and X is a vector of socioeconomic variables. Mean willingness-to-pay can be estimated from Equation (1) using procedures established by Hanemann (1984) or Cameron (1988).

In addition to the bid probability function, another useful tool for the resource manager is a site demand function which shows the relationship between user fees and trips demanded. Such a demand function would allow managers to estimate changes in visitation, revenue capture potential, revenues collected as a result of different fee structures, and demand elasticities (Cameron 1988; McConnell 1990; Mitchell and Carson 1989; Sellar and others 1986). In traditional travel cost method (TCM) studies, this site demand function is estimated indirectly from a "first-stage" demand function for trips, and is termed the "second-stage" demand function (Walsh 1986).

In this study, the trip response method (TRM) was used to directly estimate the "second stage" site demand function. In the TRM, survey respondents are given a hypothetical user fee amount and asked to state how many trips they would make to the site at that fee amount. Fee amounts are varied across the sample to obtain the data necessary for econometrically estimating a site demand function.

The general site-demand function to be estimated is:

(2) $$Q = ](C, M, X),$$

where Q equals the annual number of trips to be taken, C equals the hypothetical fee (added cost), and M and X are as specified previously. Specification of the model in this form allows direct calculation of the "second stage" demand function.

The total WTP (or consumer surplus) can then be found by taking the integral of the area under this demand curve from zero to the choke price $c^*$,

(3) $$WTP = \int_0^{c^*} (C, M, X)\, dc \ .$$

The value obtained in (3) can be compared to WTP values derived from the CVM. For a more detailed discussion of model specification see Teasley and Bergstrom (1992).

## EMPIRICAL CASE STUDY

### Study Area, Design, and Procedures

The general study area was in two National Forests in the Southeast, the Cherokee (CK) and the George Washington (GW). Specifically, in the Ocoee and Warm Springs Districts, respectively. CK and GW Forest managers are interested in information concerning revenue capture potential associated with recreation fees. The issue has come to the forefront as a result of increased opposition to below-cost timber sales and the desire to explore alternative revenue sources.

A questionnaire was designed to collect the data necessary for estimating a CVM-based bid probability function, and a TRM-based site demand function. The CVM valuation question used the dichotomous-choice approach with an annual vehicle pass as the bid vehicle. The annual vehicle pass would allow everyone in a vehicle to use sites in the District throughout the year. Respondents were asked to reply "yes" or "no" to a specific bid amount with the assumption that a "no" response would preclude them from recreating in the District in question. The TRM valuation question asked for the number of trips the respondent would take to a specific site in a District, given a daily, per person admission fee.

Both questions were asked on-site in a face-to-face interview and were included as part of a larger survey obtaining use, satisfaction, and demographic information. Surveys were delivered at specific designated sites within each Forest. Interviewers were instructed to be completely neutral in delivery and to give a minimum of extraneous information concerning the question. Interviews were conducted only with those recreationists who were leaving the area in order to gain more complete knowledge of their stay. The CVM and TRM valuation questions are reproduced in Appendix A. Response rates were almost 100 percent for the survey as each respondent was contacted in a face-to-face manner.

A survey sampling plan was constructed through intense contact with Forest and district personnel, site visits, and accumulated experience from Ken Cordell and others from the SE station. Estimates of use by site and activity were gathered from Forest personnel. These figures were then compared to the total number of surveys required and the estimated percentage of each activity within the Forest. Target numbers of surveys for each activity were then constructed so that the targeted 600 surveys would be representative of the activities occurring within the districts. The target number of surveys per activity was then split into site categories so that interviewers could go to the appropriate sites for collection of specific activity groups.

As with any large surveying project, some targets and plans have to be amended or changed after survey implementation. In this study, certain sites in each of the two Forests had to be abandoned because of low visitation or dangerous conditions for the interviewers. Also, numbers of surveys in particular targeted activity groups had to be adjusted to reflect errors in estimating the percentage of use by that activity. Total number of surveys collected for both Districts numbered approximately 1,100.

**Protest bids**--A common practice in CVM studies is to identify and eliminate respondents suspected of being "protest bidders" (Boyle and Bishop 1988; Cummings and others 1986; Reiling and others 1989). In our survey, respondents who refused to pay the stated user fee for recreation (annual vehicle pass or daily admission fee) were asked to give a reason. Protest bidders were considered to be those who responded that they "objected to these types of questions" or stated that the valuation question was "unclear to them". In either case, refusal to pay the stated user fee does not appear to reflect the respondent's true valuation of recreational access.

Table 1 shows the number of observations in total and the resulting number used for estimation after protest bidders were dropped (note - approximately 300 surveys were unusable because of interviewer error or lack of respondent cooperation with valuation questions). Elimination of protest bids did little to change valuation results. In all cases WTP rose slightly (due, in part, to the omission of zero responses). Estimation results over both logit and tobit procedures "tightened" and explanatory power rose.

Table 1—Protest bid adjustment and resulting number in data set

| Data set | Model TRM | Model CVM |
|---|---|---|
| Total set | 770 (100%) | 768 (100%) |
| Adjusted set | 561 (65.2%) | 682 (64.3%) |

Estimation Results

The TRM-based site demand function in (2) was estimated using TOBIT analysis. The demand function results fit well with coefficient estimates having expected signs at fairly high levels of statistical significance. The logit function in (1) was estimated using logistic regression. All the estimated coefficients had signs as expected. The percent of values correctly predicted by this model was 77.3 percent.

WTP values were calculated from the estimation results using the trapezoidal rule of integration under the logit function and the second stage demand function for the TRM. Table 2 presents the results of this procedure for each Forest. The TRM produced estimates of annual WTP for a site and the CVM produced annual WTP for a District. For a more detailed discussion of estimation results see Teasley (1991) and Teasley and Bergstrom (1992).

Table 2—WTP values for each forest by model

| Item | Model CVM | | Model TRM | |
|---|---|---|---|---|
| National forest | George Washington | Cherokee | George Washington | Cherokee |
| Dollar value | 55.14 | 55.12 | 7.72 | 9.05 |

Revenue Capture Potential

The overall purpose of this research was to provide the Forest Service with information about techniques for assessing total revenue capture potential, and suggest specific fee collection strategies which might be used to capture some of this revenue. The estimated site demand function was used to assess revenue-capture potential using a daily admission fee. The estimated bid probability function was used to assess revenue-capture potential using an annual vehicle pass. The use of these techniques to assess revenue-capture potential is demonstrated below through an application to hypothetical visitor use data for the Warm Springs District of the GW National Forest.

1. Annual district vehicle pass--The CVM results were first used to estimate the levels of participation shown in table 3. Equation (1) was specified empirically as:

$$Z = \frac{e^{\alpha + \beta_1 P}}{(1 + e^{\alpha + \beta_1 P})} , \qquad (4)$$

where Z is the probability that a typical group is willing-to-pay the annual vehicle pass, $\alpha$ is the constant term, $\beta_1$ is the coefficient of the bid variable, and P is the logged fee amount (Teasley and Bergstrom 1992). Plugging in values for P and solving produced estimates of Z at various fee amounts. Table 3 shows the differing probabilities of a typical group being willing-to-pay for an annual vehicle pass as estimated by (4) for the GW National Forest.

The total revenue capture potential for the District can then be estimated by the equation:

(5) REVENUE = FEE x Z x G, where:

REVENUE=revenue for District.
FEE=proposed annual fee.
Z=probability that typical group is willing-to-pay fee (see table 3).
G=estimate of annual number of groups currently visiting the district.

In equation (5) above, G can be estimated by dividing an estimate of annual group visits (e.g., vehicle counts) by an estimate of annual visits per group (for example, 7). As an exercise, consider the following example. With an annual vehicle count of 200,000 (V), G is 28,571 (200,000/7=28,571). Therefore, using equation (5) in conjunction with the percentages found in table 3, we can estimate possible revenue capture amounts at varying fee rates. The results in table 4 suggest that District revenue would be maximized by setting the annual vehicle fee at about $45 per year.

2. Daily site admission fee--Unlike the annual vehicle pass, the daily site admission fee is a charge per person per trip. Thus, the fee explicitly increases the price per trip paid by each visitor. Demand theory suggests that as the price per trip increases, trips demanded should decrease. Results of the TRM were used to estimate the percent reduction in person visits. Evaluating a slightly more detailed equation (2) resulted in the term R which represents the percent reduction in visits for a typical visitor (Teasley and Bergstrom 1992). table 5 shows the percent reduction in person visits to sites which would be caused by various daily admission fees.

Again, as an exercise, consider the example below. With annual visitation of 100,000 to a site (V) and reductions in number of trips by fee charged as listed in Table 5 (R), we get the results shown in Table 6. Note in table 6 that revenue would be maximized at a daily admission fee of about $5.00 per person.

Table 3—Example of probability of typical groups being willing-to-pay fee price for the district

| Annual fee amount | Percentage of groups willing to pay fee |
|---|---|
| dol. | pct. |
| 1 | 96.1 |
| 2 | 92.5 |
| 5 | 83.1 |
| 7.5 | 72.5 |
| 10 | 70.4 |
| 15 | 60.5 |
| 25 | 46.1 |
| 45 | 28.6 |
| 65 | 18.4 |
| 85 | 11.7 |
| 110 | 5.9 |
| 150 | 0 |

Table 4—Example of estimated revenue capture potential for annual vehicle pass

| Annual fee ($) | | Percentage of groups willing to pay fee | | Number of groups currently visiting the district | | Annual revenue ($) |
|---|---|---|---|---|---|---|
| FEE | (X) | P | (X) | G | = | REVENUE |
| 1 | | 96.1 | | 28,571 | | 27,457 |
| 2 | | 92.5 | | 28,571 | | 52,856 |
| 5 | | 83.1 | | 28,571 | | 118,712 |
| 7.5 | | 72.5 | | 28,571 | | 155,355 |
| 10 | | 70.4 | | 28,571 | | 201,140 |
| 15 | | 60.5 | | 28,571 | | 259,282 |
| 25 | | 46.1 | | 28,571 | | 329,281 |
| 45 | | 28.6 | | 28,571 | | 367,709 |
| 65 | | 18.4 | | 28,571 | | 341,709 |
| 85 | | 11.7 | | 28,571 | | 284,139 |
| 110 | | 5.9 | | 28,571 | | 185,425 |
| 150 | | 0 | | 28,571 | | 0 |

Total revenue capture potential for a particular site can then be estimated by:

(6) REVENUE = FEE x (1 - R) x V, where:

REVENUE=revenue for a site.
FEE=proposed daily admission fee.
R=percent reduction in person visits at each fee level (see table 5).
V=estimate of current annual person visits to site (or, number of group visits x persons per group).

Table 5—Example of percent reduction in annual trips per daily fee levels for the site

| Annual fee amount | Percentage of reduction in trips to site |
|---|---|
| dol. | pct. |
| 1 | 19.8 |
| 1.5 | 28.2 |
| 2 | 35.5 |
| 3 | 48.5 |
| 5 | 66.7 |
| 7.5 | 80.8 |
| 10 | 89.1 |
| 12.5 | 93.8 |
| 15 | 96.4 |
| 20 | 99.0 |
| 25 | 99.5 |
| 35 | 100.0 |

Table 6. Example of estimated revenue capture potential for the daily admission fee

| Daily fee ($) | | Percent of original trips to site | | Current visitation to the site | | Estimated annual revenue ($) |
|---|---|---|---|---|---|---|
| **FEE** | **X** | **(1-R)** | **X** | **V** | **=** | **REVENUE** |
| 1 | | .802 | | 100,000 | | 80,200 |
| 1.5 | | .718 | | 100,000 | | 107,700 |
| 2 | | .645 | | 100,000 | | 129,800 |
| 3 | | .515 | | 100,000 | | 154,500 |
| 5 | | .333 | | 100,000 | | 166,500 |
| 7.5 | | .192 | | 100,000 | | 144,000 |
| 10 | | .109 | | 100,000 | | 109,000 |
| 12.5 | | .062 | | 100,000 | | 77,500 |
| 15 | | .036 | | 100,000 | | 54,800 |
| 20 | | .010 | | 100,000 | | 20,000 |
| 25 | | .005 | | 100,000 | | 12,500 |
| 35 | | .0004 | | 100,000 | | 1,400 |

## IMPLICATIONS

Clearly, the two revenue capture strategies can produce differing amounts of revenue potential. Using pure revenue capture maximization as the decision rule in our GW National Forest example, the annual vehicle pass would be set at forty-five dollars and the daily admission pass at five dollars. However, managers may be constrained legally by the amounts they can charge or by equity considerations. Setting a daily admission pass of five dollars would price an estimated 67 percent of trips by current users out of the market. This result may not be desirable from a equity or public relations standpoint, especially considering that a National Forest is public land. On the other hand, the annual vehicle pass would reduce groups using the Forest District by 71 percent. Visitation objectives and guidelines which managers operate under will affect the revenue capture strategy at a particular recreation site or area.

The fact that expected visitation appears sensitive to the type of fee payment scheme used is not a surprising result. For example, respondents may take as many trips after a lump sum payment, such as an annual vehicle pass, as they would have taken without one. Arguments against this hypothesis consider that respondents may amortize the lump sum payment over a year's trips and adjust trips accordingly. On the other hand, a payment scheme such as a daily pass results in an explicit increase in the price per trip, this in turn causes recreationists to adjust trips downward.

The differences between the two models may also be due to payment vehicle problems. Previous studies demonstrate that the type of payment vehicle used can influence valuation behavior and results (Bergstrom and Stoll 1989; Rowe and Chestnut 1983; Schulze and others 1981). For example, different payment vehicles may induce varying levels of protest bidding which can affect values derived from contingent valuation studies. Or, payment vehicle effects may occur in the valuation estimation without being manifested in protest bidding.

It was conjectured that a TRM approach may provide a more neutral means of asking revenue-capture questions in a survey format. More research is needed, however, before any firm conclusions can be drawn regarding the relationship between protest bidding and CVM vs. TRM questions. An interesting aspect of the "trip response model" is that the results (the second stage demand curve) can be directly compared to estimation results of more traditional travel cost studies. The estimated demand curve can also produce estimates of elasticity which can help recreation managers in the pricing of a recreation area (i.e. to what level they could raise prices before the "revenue/price increase" ratio drops below 1). Analyzing data with both methods (TRM and CVM) could make for interesting and useful future research.


ACKNOWLEDGMENTS

We gratefully acknowledge the contribution of the personnel from the district offices of the Ocoee district in the Cherokee National Forest and the Warm Springs district in the George Washington National Forest. We would also like to thank the SE Forest Service Experiment Station for it's contributions: specifically, thanks go to Ms. Karen Zera and Ms. Christine Overdevest for their data collection efforts.


REFERENCES


Bergstrom, John C. 1989. Welfare measurement concepts for non-marketed resources. The Georgia Agricultural Experiment Stations College of Agriculture, University of Georgia. Special Publication No. 53.

Bergstrom, John C.; Stoll, John R. 1989. Application of experimental economics concepts and precepts to CVM field survey procedures. Western Journal of Agricultural Economics. 14(1):98-109.

Boyle, Kevin J.; Bishop, Richard C. 1988. Welfare measurements using contingent valuation: a comparison of techniques. American Journal of Agricultural Economics. 70:20-28.

Bishop, Richard G.; Heberlein, T. A. 1979. Measuring values of extra-market goods: are indirect measures biased? American Journal of Environmental Economics. 61:926-930.

Bowker, J.M.; Stoll, John R. 1988. Use of dichotomous choice non-market methods to value the whooping crane resource. American Journal of Agricultural Economics. 70(2):372-381.

Cameron, Trudy A. 1988. A new paradigm for valuing non-market goods using referendum data: maximum likelihood estimation by censored logistic regression. Journal of Environmental Economics and Management. 15:355-379.

Cummings, R.G.; Brookshire, D.S.; Schulze, W.D. 1986. Valuing environmental goods: an assessment of the contingent valuation method. Totowa, NJ: Rowan and Allanheld. 363 p.

Hanemann, W. Michael. 1984. Welfare evaluations in contingent valuation experiments with discrete responses. American Journal of Agricultural Economics. 66(3):332-342.

Loomis, John; Thomas, Michael. 1989. Pricing and revenue capture: converting WTP into state and private revenue. Draft presented at the Alaska Department of Fish and Game/Rocky Mountain Station Workshop. Sept. 1989.

Mitchell, Robert Cameron; Carson, Richard T. 1989. Using surveys to value public goods: the contingent valuation method. John Hopkins University Press, Resources for the Future. 282 p.

McConnell, K.E. 1990. Models for referendum data: the structure of discrete choice models for contingent valuation. Journal of Environmental Economics and Management. 18:19-34.

Price, Colin. 1990. Charging versus exclusion: choice between recreation management tools. Environmental Management. 5(2):161-175.

Reiling, Stephen D.; Boyle, Kevin J.; Cheng, Hsiang-tai; Phillips, Marcia L. 1989. Contingent valuation of a public program to control black flies. Northeastern Journal of Agricultural and Resource Economics. 18(2):126-134.

Rowe, Robert D.; Chestnut, Lauraine G. 1983. Valuing environmental commodities: revisited. Land Economics. 59(4):404-410.

Schulze, William D.; d'Arge, Ralph C.; Brookshire, David S. 1981. Valuing environmental commodities: some recent experiments. Land Economics. 57(2):151-172.

Sellar, C.; Chavas, J.P.; Stoll, J.R. 1986. Specification of the logit model: the case of valuation of non-market goods. Journal of Environmental Economics and Management. 13:382-390.

Teasley, R. Jeff. 1991. Revenue capture strategies for non-commercial use of publicly owned land and water resources. Athens: University of Georgia. 128 p. Thesis.

Teasley, R. Jeff; Bergstrom, John C. 1992. Estimating revenue-capture potential associated with public area recreation. Faculty Series FS92-15, Agricultural and Applied Economics Dept., University of Georgia, Athens, GA. 17 p.

Walsh, Richard G. 1986. Recreation economic decisions comparing benefits and costs. State College, PA: Venture Publishing, Inc. 346 p.

**Appendix A**

**CVM Question**

**Suppose a type of pass was offered allowing you (and anyone in your vehicle) to visit any area operated by this agency in (location) for one year. This pass would not cover camping fees. The money from the fee would be used to maintain these areas in their present condition, but there would be no improvements. If the price of this year's annual pass was $_____, would you have bought one?**

**____ Yes**

**If that fee were charged, about how many days would you use the site over the next 12 months?**
**_____ days**

**____ If No then go to reasons below**

**_____ We do not visit (location) enough to justify buying a pass**

**_____ There are many other areas to visit besides (location)**

**_____ We cannot afford to buy the pass**

**_____ Question was not clear to me**

**_____ I do not believe fees should be charged**

**_____ Some other reason (specify) ____________________________**

**TRM Question**

**Suppose the agency managing this site started charging a daily admission fee of $_____/person. The money from the fee would be used to maintain the site in its present condition, but there would be no improvements. This fee would not cover camping fees. Would you continue to use the site?**

**_____ Yes**

**If that fee were charged, about how many days would you use the site over the next 12 months?**
**_____ days**

**_____ If No go to reasons below**

**_____ I do not visit this site enough to justify buying a pass**

**_____ There are many other sites to visit besides this one**

**_____ I cannot afford to buy the pass**

**_____ Question was not clear to me**

**_____ I do not believe fees should be charged**

**_____ Some other reason (specify) ____________________________**